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**Question Paper Code: 54702**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Mechanical Engineering

15UME402 – KINEMATICS OF MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The relation between number of links and number of lower pairs is given as  $n = 2p - 4$ . If L.H.S is less than R.H.S of this equation then the chain is CO1- U
  - constrained
  - locked
  - locked
  - unconstrained
- The mechanism used in a shaping machine is CO1-R
  - A closed 4-bar chain having 4 revolute pairs
  - A closed 6-bar chain having 6 revolute pairs
  - A closed 4-bar chain having 2 revolute and 2 sliding pairs
  - An inversion of the single slider-crank chain
- The direction of linear velocity of any point on a link with respect to another point on the same link is CO2-U
  - Parallel to the link
  - At  $45^\circ$  to the link
  - Perpendicular to the link
  - None of these
- Negative acceleration is also known as -----, CO2- R
  - Retardation
  - Relaxation
  - Escalation
  - All of above
- The size of a cam depends upon -----, CO3- R
  - Base circle
  - Pitch circle
  - Prime circle
  - Pitch curve

6. For a spring-loaded roller-follower driven with a disc cam CO3- R
- (a) The pressure angle should be larger during rise than that during return for ease of transmitting motion.
- (b) The pressure angle should be smaller during rise than that during return for ease of transmitting motion.
- (c) The pressure angle should be large during rise as well as during return for ease of transmitting motion
- (d) The pressure angle does not affect the ease of transmitting motion
7. An imaginary circle which by pure rolling action, gives the same motion as the actual gear, is called CO4- R
- (a) Addendum circle (b) Dedendum circle
- (c) Pitch circle (d) Clearance circle
8. Interference is caused by? CO4-U
- (a) Overlapping of tooth profiles (b) Large size of dedendum
- (c) Meshing of involute and no-involute profiles (d) All of the mentioned
9. A differential gear in automobiles is used to CO5- R
- (a) Reduce speed (c) Provide jerk-free movement of vehicle
- (b) Assist in changing speed (d) Help in turning
10. When the axes of first and last gear are co-axial, then gear train is known as CO5- R
- (a) Simple gear train (b) Compound gear train
- (c) Reverted gear train (d) Epicyclic gear train

PART – B (5 x 2= 10Marks)

11. Define the term Kinematic Chain CO1-U
12. Define Rubbing velocity. CO2-U
13. Give some examples of cam. CO3-U
14. Define contact ratio CO4-U
15. What is the advantage of a compound gear train over a simple gear train? CO5-U

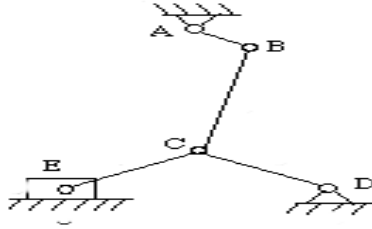
PART – C (5 x 16= 80Marks)

- 16 (a) Sketch and describe the inversions of slider crank mechanisms. CO1- U (16)  
Give examples of their applications.
- Or
- (b) (i) What are quick-return mechanisms? Where are they used? CO1-U (8)  
Discuss the functioning of any one of them

(ii) Compute the DOF for the mechanism shown below

CO1-U

(8)



17. (a) PQRS is a four bar chain with fixed link PS. The lengths of links are: PQ = 62.5mm, QR=175mm, RS=112.5mm and PS = 200mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS =60° and find the angular velocity and angular acceleration of the link QR & RS. CO2-App (16)

Or

- (b) In a slider crank mechanism, the length of the crank is 200mm and length of connecting rod 825mm. the angular velocity of crank is 60rad/s. When the crank has turned 120° from the inner dead Centre, Calculate : CO2- Ana (16)
1. The velocity of piston.
  2. Angular velocity of connecting rod.
18. (a) A cam is designed for a knife edge follower with following data: Cam lift = 40mm during 90° of cam rotation with SHM, dwell for next 30°, during the next 60°of cam rotation, the follower returns to its original position with SHM, dwell during remaining 180°. Draw the profile of the cam when the line of stroke is offset 20mm from axis of cam shaft. The radius of base circle of cam is 40mm. CO3- Ana (16)

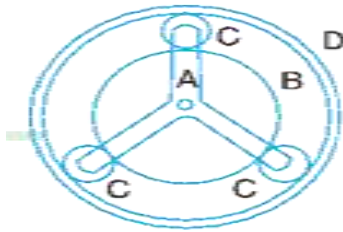
Or

- (b) Draw the profile of the cam when the roller follower moves with Cycloidal motion during out stroke and return stroke, as given below: CO3 Ana (16)
1. Out stroke with maximum displacement of 62.8 mm during 150° of cam rotation.
  2. Return stroke for the next 150° of cam rotation.
  3. Dwell for the remaining 30° of cam rotation.
- The minimum radius of cam is 35 mm and the roller diameter of the follower is 20 mm. The axis of the roller follower is passes through the axis of the cam shaft.
19. (a) A pinion of 20 involute teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25mm.What is the least pressure angle which can be used to avoid interference? With this pressure angle , find the length of arc and the minimum number of teeth in contact at a time. CO4- U (16)

Or

- (b) A pair of involute spur gears with  $16^\circ$  pressure angle and pitch of module 6 mm is 1.75, find in order that the interference is just avoided; 1. the addenda on pinion and gear wheel; 2. The length of path of contact; and 3. The maximum velocity of sliding of teeth on either side of the pitch point. CO4- Ana (16)

20. (a) In an epicyclic gear of the 'sun and planet' type shown in Fig. the pitch circle diameter of the internally toothed ring is to be 224 mm and the module 4 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sunwheel B for every five revolutions of the driving spindle carrying the sunwheel B. Determine suitable numbers of teeth for all the wheels. CO5- U (16)



Or

- (b) A four speed sliding gear box of an automobile is to be designed to give speed ratios of 4, 2.5 and 1 approximately for the first, second, third and top gears respectively. The input and the output shaft have the same alignment as shown in figure. The horizontal centre distance between them and the lay shaft is 90 mm. The teeth have a module of 4 mm. No wheel has less than 15 teeth. Calculate suitable number of teeth on each wheel and actual speed ratios attained CO5- U (16)

